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(54) **OPEN LOOP GAS BURNER**

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F23D 14/34	(2006.01)
F23D 14/02	(2006.01)
F24C 3/08	(2006.01)

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CPC ***F24C 3/085*** (2013.01); ***F23D 14/02*** (2013.01); ***F23D 14/34*** (2013.01); ***F23D 14/70*** (2013.01)

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CPC F23D 14/70; F23D 14/02; F23D 14/34; F23D 2203/102; F23D 2203/103; F23D 2203/105; F23C 3/085; F23C 7/008

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See application file for complete search history.

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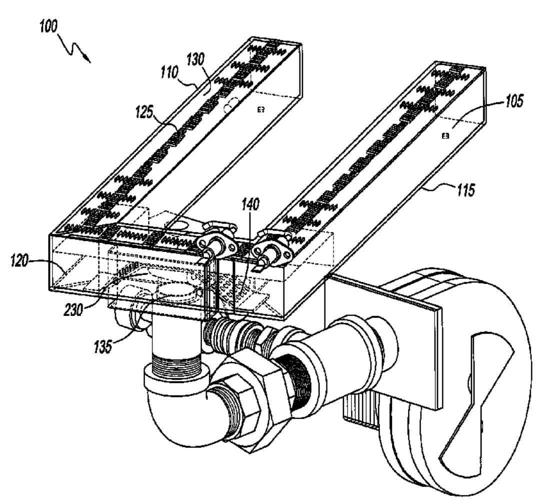
(57) **ABSTRACT**

A gas burner has an air-gas mixture distribution section with an open loop geometry and a plurality of sides. The air-gas mixture distribution section has a top heating surface and a plurality of ports are disposed on the top heating surface. An inlet is disposed on one of the plurality of sides of the air-gas mixture distribution section and a distribution diffuser is mounted inside the air-gas mixture distribution section.

12 Claims, 7 Drawing Sheets



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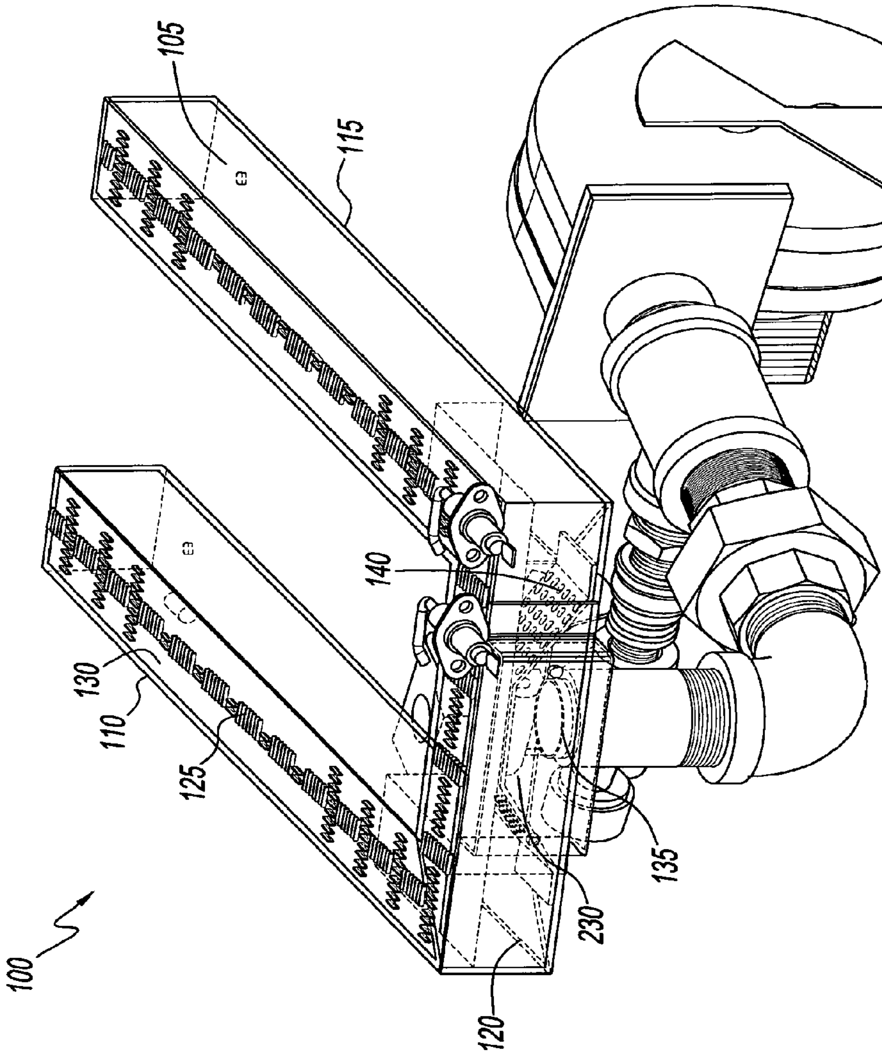

Fig. 1

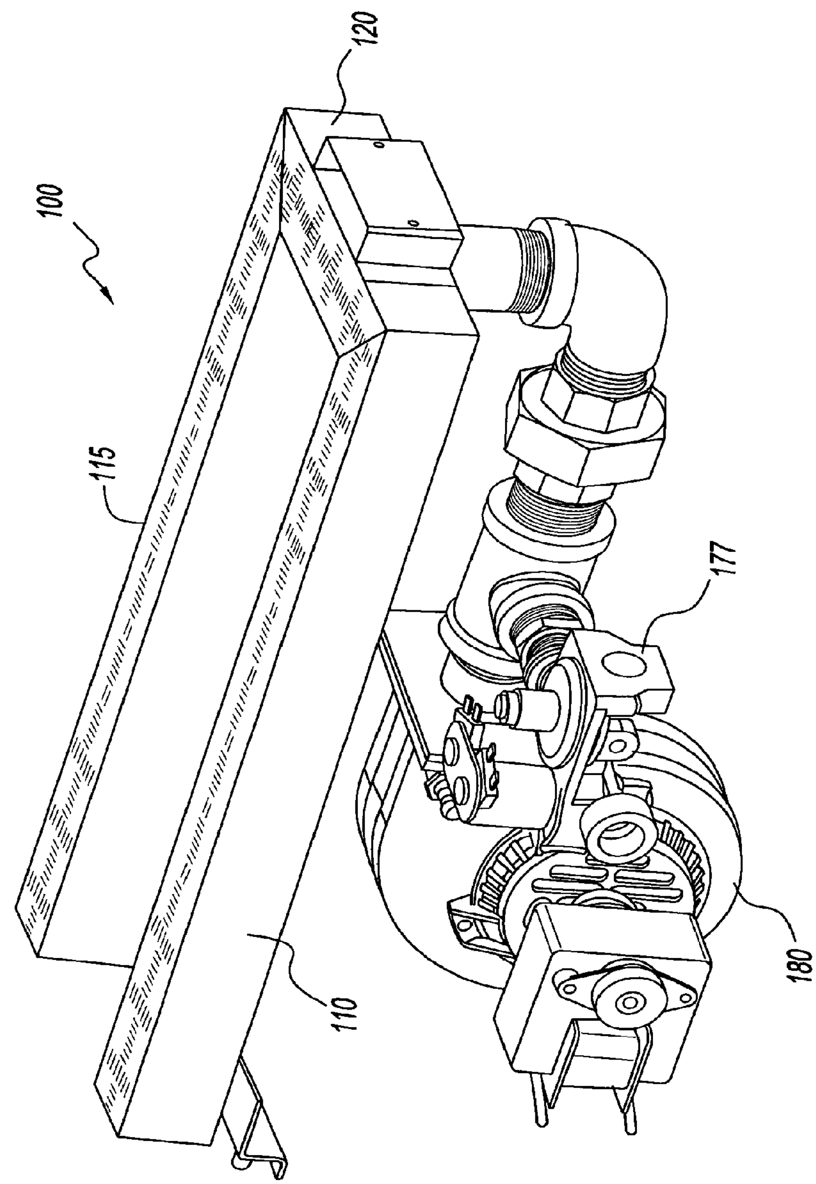

Fig. 2

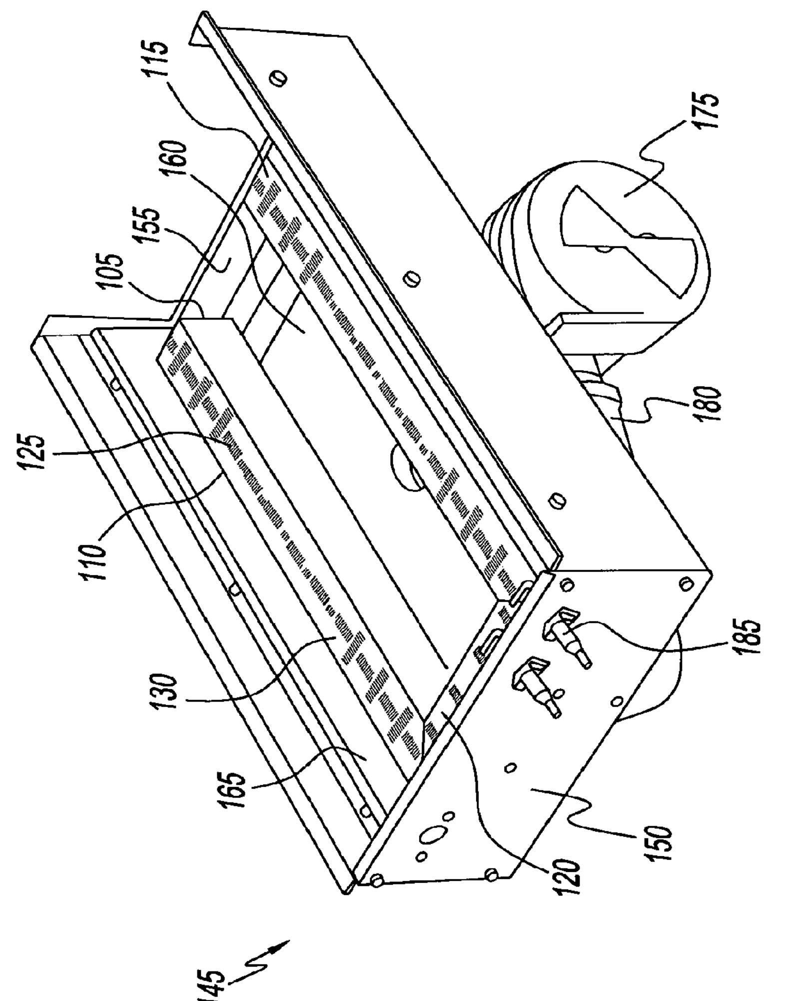

Fig. 3

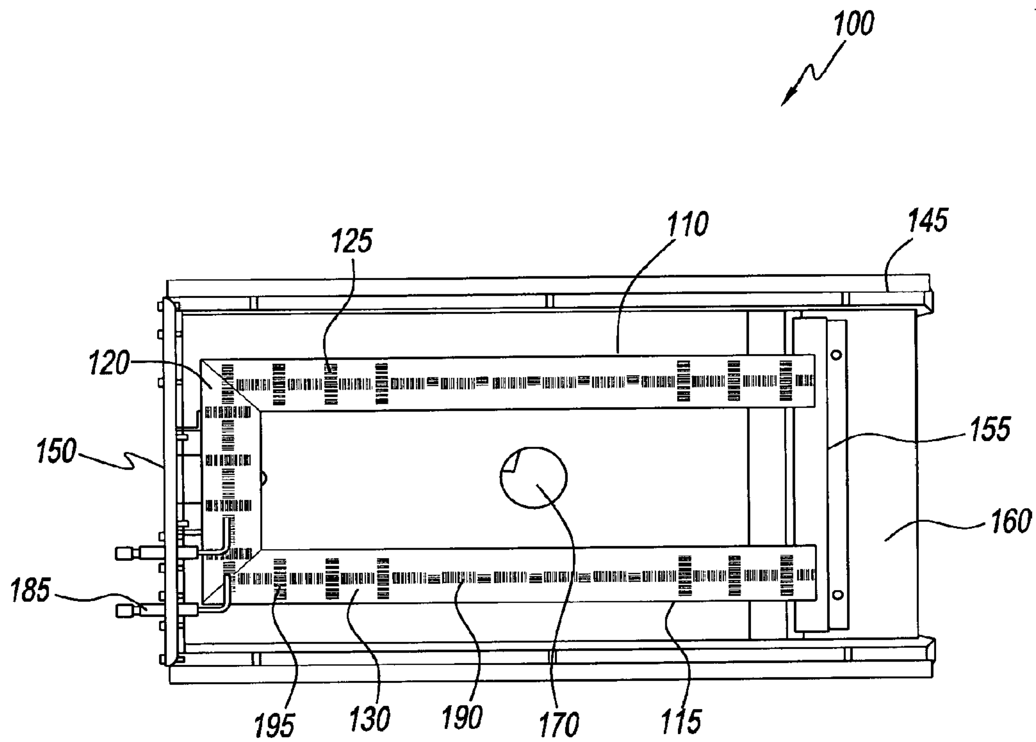

Fig. 4

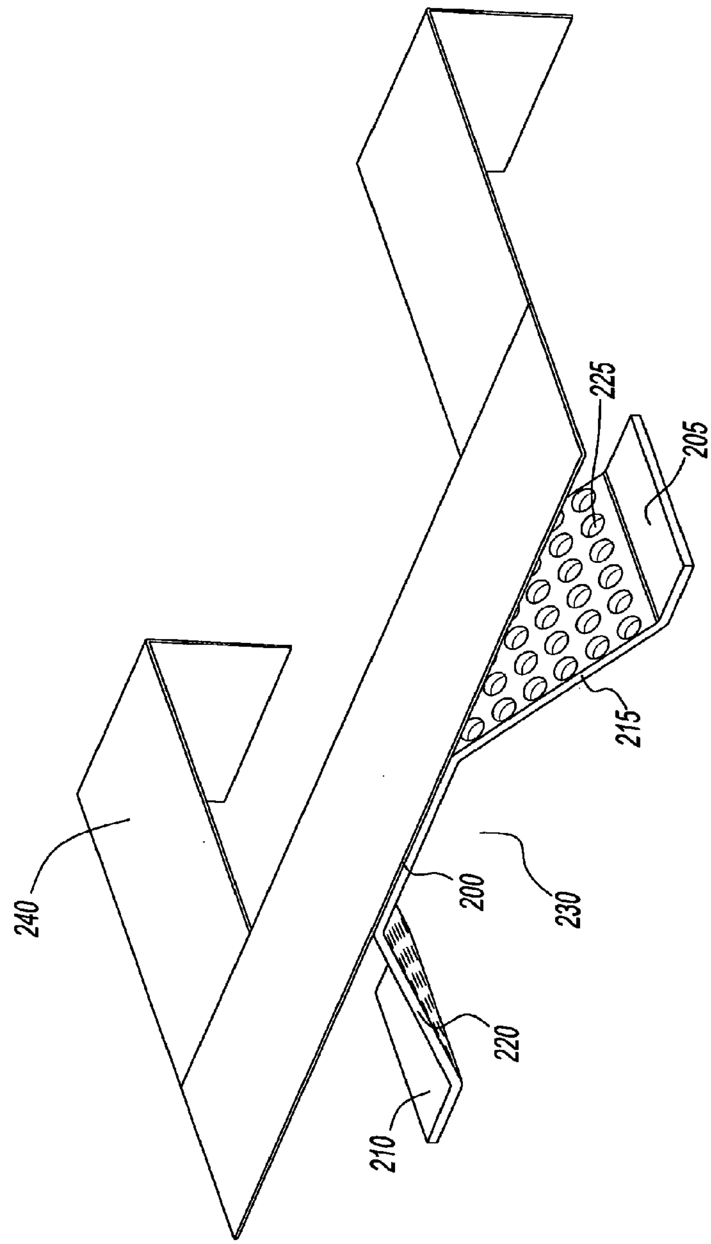

Fig. 5

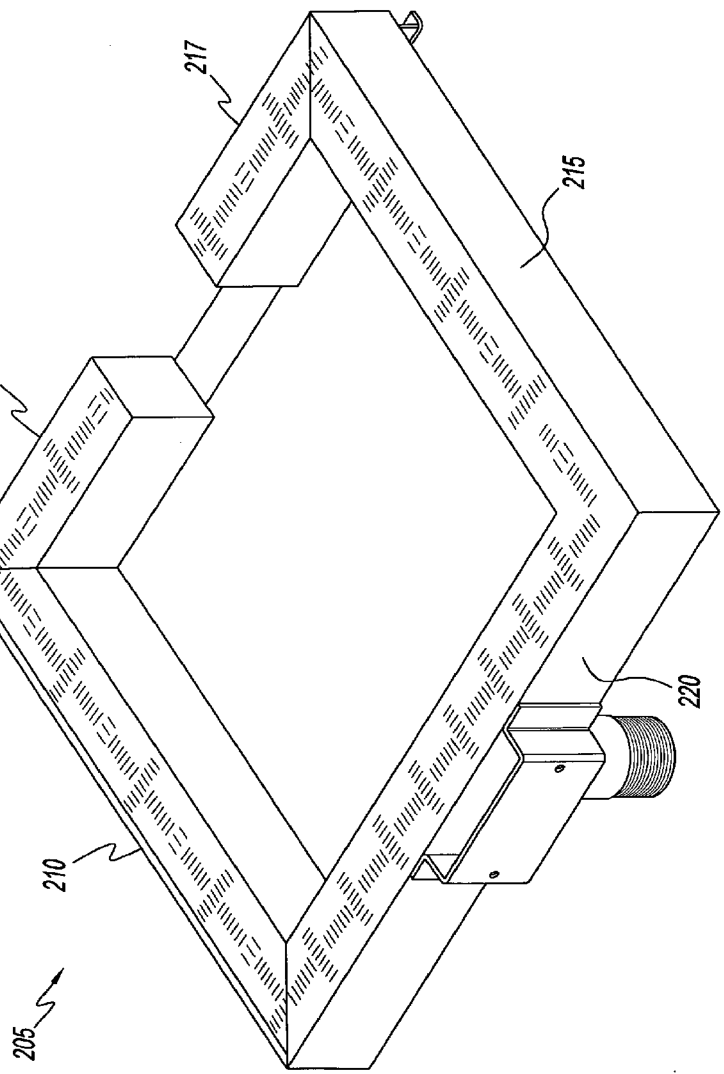

Fig. 6

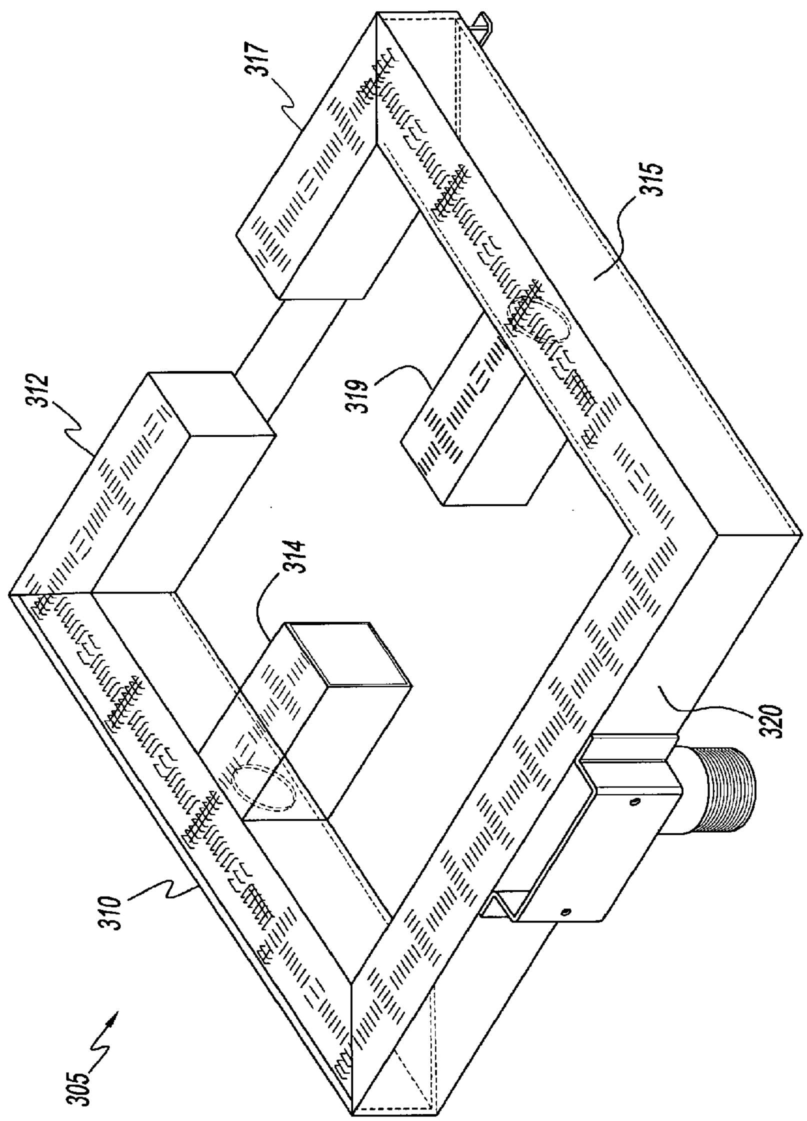

Fig. 7

OPEN LOOP GAS BURNER

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims priority to U.S. Provisional Application No. 61/011,520, filed on Jan. 18, 2008.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present disclosure relates to a gas burner having an open loop geometry that achieves uniform or distributed flame characteristics, uniform or distributed heating conditions and an even pressure distribution throughout the burner.

2. Description of Related Art

Traditional gas burners are used in grill and griddle assemblies to heat a cooking surface. There are two types of gas burners that are commonly used that include an atmospheric burner and a powered burner. The atmospheric burner relies solely on static pressure of the gas from a gas supply to provide an air-gas mixture at various burner ports where the air-gas mixture may be ignited to create a flame. The powered burner utilizes a fan or blower and is connected to a supply of gas prior to an inlet of the burner in order to enhance the mixing of air and gas and to further provide the air-gas mixture to the burner at a pressure that is generally higher than atmospheric pressure.

Traditional gas burners exhibit performance deficiencies due to non-uniform flame characteristics, non-uniform heating conditions and uneven pressure distribution that are inherent with the design of the burner. Non-uniform flame characteristics of traditional gas burners often create the non-uniform heating conditions on the cooking surface. These non-uniform heating conditions manifest themselves as localized hot or cold spots along the cooking surface resulting in unpredictable and inconsistent cooking.

Non-uniform flame characteristics are primarily a result of the geometry of the gas burner. The closed loop geometry has a flue on the back end of the burner that results in all of the flue gas migrating to that particular region. The migration of the flue gas to the back end results in an excess heat build-up in that region and consequently, there are non-uniform flame characteristics and non-uniform heating conditions.

The uneven pressure distribution in traditional gas burners is primarily a result of the positioning of the diffuser directly under the ports of the burner. This configuration does not provide a space for the gas to even out the pressure above the diffuser because of the close proximity of the ports. The uneven pressure distribution created by the positioning of the diffuser can also result in popping, flashback, or excess flame lifting because of the non-uniform distribution of gas throughout the distribution section of the gas burner. Furthermore, the location of the diffuser and the inlet in traditional gas burners gives the burner a front to rear overall dimension that can lead to packaging difficulties. It would be more advantageous to have a final assembly that is shorter from the front to rear of the gas burner.

Accordingly, there is a need for a gas burner that achieves uniform or distributed flame characteristics as needed, uniform or distributed heating conditions and an even pressure distribution throughout the burner. Furthermore, a gas burner is needed that has a geometry that provides stable combustion, eliminates popping and flashback, and has improved overall energy efficiency.

SUMMARY OF THE INVENTION

The present disclosure provides a gas burner having an open loop geometry that achieves uniform flame characteristics distributed from a plurality of burner ports. The plurality of burner ports are distributed to obtain an even temperature distribution on the surface being heated by the burner.

The present disclosure further provides a gas burner having an air-gas mixture distribution section with uniform or distributed heating conditions and even pressure distribution throughout the burner. The air-gas mixture distribution section provides fully mixed air and gas that is delivered to the burner ports.

The present disclosure still further provides an inlet to the air-gas mixture distribution section that is coupled to a supply of combustible gas.

The present disclosure also provides a gas burner having a fan coupled to the inlet of the burner that mixes air with a combustible gas and provides it to the gas burner at an increased pressure.

The present disclosure yet further provides that the ports of the burner have several slots formed into a substantially flat upper surface of the air-gas mixture distribution section and arranged to balance the thermal characteristics of the burner. The ports are configured to form a pattern that is designed to provide the desired temperature distribution to the surface being heated. In one embodiment, the ports are arranged in an array that has sequences of port rows interleaved with sequences of port columns.

The present disclosure also provides a gas burner having a distribution diffuser located near the inlet to the air-gas distribution section. The distribution diffuser is located between the inlet to the air-gas mixture distribution section and the top heating surface and extends along the sides of the burner to such a distance so that the pressure of the air-gas mixture within the burner is balanced. This geometry provides a bottom fuel entry instead of the traditional front fuel entry, though the present disclosure also contemplates the use of the traditional front entry.

These and other advantages and benefits of the present disclosure are provided by a gas burner having an air-gas mixture distribution section formed in an open loop geometry. The gas burner can have any number of sides designed to provide an open loop geometry. In one embodiment, the gas burner has a first side, a second side and a third side. The air-gas mixture distribution section has a top heating surface. A plurality of ports are disposed on the top heating surface. The air-gas mixture distribution section has an inlet disposed thereon and a distribution diffuser mounted therein.

The above-described and other features and advantages of the present disclosure will be appreciated and understood by those skilled in the art from the following detailed description, drawings, and appended claims.

DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

FIG. **1** is a right-side perspective view of a first embodiment of the gas burner of the present disclosure having an open loop geometry.

FIG. **2** is a left-side perspective view of the gas burner of FIG. **1**.

FIG. **3** is a perspective view of the gas burner of FIG. **1**, in which the gas burner is depicted in a burner tray assembly.

FIG. **4** is top plan view of the gas burner of FIG. **1**, in which the gas burner is mounted in the burner tray assembly of FIG. **3**.

FIG. **5** is a perspective view of the distribution diffuser of FIG. **1**.

FIG. 6 is a right-side perspective view of a second embodiment of the air-gas distribution section used in the gas burner of FIG. 1.

FIG. 7 is a right-side perspective view of a third embodiment of the air-gas distribution section used in the gas burner of FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawings and, in particular, FIG. 1, a gas burner generally referred to by reference number **100** is shown. In one embodiment, gas burner **100** has an air-gas mixture distribution section **105**. Air-gas mixture distribution section **105** has an open loop, or U-shaped geometry, that has a plurality of sides. In one embodiment, air-gas mixture distribution section **105** has two long sides **110** and **115** and one short side **120**. A plurality of apertures or ports **125** are disposed on a top heating surface **130** of air-gas mixture distribution section **105** that in the present configuration is substantially flat. Gas burner **100** further includes an inlet **135** at an end of air-gas mixture distribution section **105**. A distribution diffuser **140** is provided near inlet **135**.

The gas burner **100** of the present disclosure advantageously utilizes heat more efficiently because there are no burner ports disposed at the back end of the burner and thus, there is an outlet for flue gases to escape. The open loop geometry of gas burner **100** provides a natural heat convection through the back end of the burner because it eliminates heat where it is not needed. The hot flue gases in the back end provide residual heat to that area of the burner. Furthermore, gas burner **100** is more energy efficient because a smaller quantity of gas is necessary to achieve the same thermal characteristics. Flame stability is improved because less input is needed to achieve the desired temperature distribution. In addition, gas burner **100** has improved control and accuracy, and has made packaging the burner easier because of the flexibility of the design.

Distribution diffuser **140** provides an even pressure distribution to air-gas mixture distribution section **105**. The even distribution of pressure further helps to provide uniform or distributed flame characteristics to ports **125**. In one embodiment, distribution diffuser **140** is located between the inlet **135** and top heating surface **130** in such a way as to balance the pressure of the air-gas mixture within burner **100**. Distribution diffuser **140** can also extend along long sides **110**, **115** to a distance sufficient to balance the pressure of the air-gas mixture within burner **100**.

Referring specifically to FIG. 5, distribution diffuser **140** is shown having a top surface **200**, two bottom surfaces **205**, **210** and two side surfaces **215**, **220**. Side surfaces **215**, **220** have a plurality of holes **225** therein. Top surface **200** can be made of a fine mesh screen. The configuration of distribution diffuser **140** is advantageous because it creates a lower chamber **230** disposed below top surface **200**, and between side surfaces **215** and **220**. The gas pressure can even out within lower chamber **230**, and then be distributed through the entire air-gas mixture distribution section **105** more evenly.

This configuration is also advantageous because it provides for a bottom fuel entry instead of the traditional front fuel entry. Also, this configuration provides additional unexpected results that include uniform or distributed flame characteristics, uniform or distributed heating conditions and an even pressure distribution throughout burner **100**. Another advantage of having this configuration of distribution diffuser **140** is that it makes manufacturing easier because there is flexibility in where the fuel can enter air-gas mixture distribution section **105**. Furthermore, popping and flashback are eliminated in the aforementioned design of distribution diffuser **140**. The present disclosure also contemplates a front fuel entry to air-gas distribution section **105**.

Diffuser **140** can have screen **240** that is connected to top surface **220**. Screen **240** can extend along short side **120**, and at least partially along long sides **110** and **115**. Screen **240** thus further assists in the balancing of the air-gas mixture pressure within distribution section **105**. Screen **240** can be made from a meshed material, so that the air-gas mixture can pass through it, and out of ports **125**.

Referring to FIG. 3, the gas burner **100** can be installed within a burner tray assembly **145**. Burner tray assembly **145** includes a front wall **150**, a back wall **155** and a bottom wall **160**. In one embodiment, burner tray assembly **145** has an insulation layer **165** disposed therein. Insulation layer **165** is disposed along the interior of front wall **150**, back wall **155** and bottom wall **160**. Insulation layer **165** can comprise an insulation material. Alternatively, there can be a layer of air disposed along the interior of front wall **150**, back wall **155** and bottom wall **160**, to provide insulation. In another embodiment, burner tray assembly **145** has a temperature sensor **170**. Temperature sensor **170** extends through bottom wall **160** and through an open region approximately centrally located in burner heating area of gas burner **100**.

Gas burner **100** is controlled by valving that includes a gas inlet valve **177**, a blower **175** and a feed pipe **180**. Inlet valve **177** and blower **180** are in fluid communication with feed pipe **180** and provide air and gas to feed pipe **180**. Feed pipe **180** extends through front wall **150**, and is in fluid communication with distribution section **105**, to provide an air-gas mixture to gas burner **100**. Blower **175** facilitates the mixing of the air with the gas and further provides the air-gas mixture to gas burner **100** that is at a pressure greater than atmospheric pressure. An igniter **185** also extends through front wall **150** to ignite the fuel flow that is at top heating surface **130** of gas burner **100**. In one embodiment, a controller (not shown) can operate inlet valve **177**, blower **175** and igniter **185** automatically. In another embodiment, inlet valve **177**, blower **175** and igniter **185** can be operated manually.

Referring now to FIG. 4, an overhead view of gas burner **100** is shown. In one embodiment, ports **125** can be in an array that has sequences of port rows **190** interleaved with sequences of port columns **195**. In one embodiment, ports **125** have an elongated rectangular or slot shape so that there are uniform or distributed flame characteristics throughout the entire top heating surface **130**. The array has a lesser number of ports **125** in the portions of long sides **110** and **115** in the vicinity of temperature sensor **170** than in all other portions of gas burner **100**. In another embodiment, ports **125** can have any other arrangement that provides uniform or distributed flame characteristics and uniform or distributed heating conditions to the surface above gas burner **100**. For example, ports **125** can be oriented substantially transverse or parallel to a longitudinal axis off long sides **110** and **115** and short side **120** of gas burner **100**. Ports **125** can be holes, slots or any other shape that effectively releases a combustible gas. The port array provides gas burner **100** with a substantially uniform heat distribution and optimal thermal characteristics.

In the shown embodiments, long sides **110** and **115**, and short side **120**, of air-gas distribution section **105** are a series of rectangular or square shapes. The present disclosure, however, also contemplates other shapes for the sides of the air-gas distribution section **105**, such as round, obround, triangular, and others suitable for providing flame to the surface to be heated.

Referring to FIGS. 6 and 7, alternative configurations for the air-gas distribution section of the present disclosure are shown. As shown in FIG. **6**, air-gas distribution section **205** has base side **220**, left side **210**, and right side **215**. Left side **210** and right side **215** further have end burner sections **212** and **217**, respectively, connected thereto. End burner sections **212** and **217** project toward each other in a direction away from left side **210** and right side **215**, respectively, and thus provide enhanced coverage for heating the surface that is located above air-gas distribution section **205** when burner **100** is in use. Distribution section **205** thus resembles a square or rectangle with an opening at one end. The open-loop geometry, and all of the advantages of the same discussed above, is maintained in this arrangement.

As shown in FIG. **7**, air-gas distribution section **305** has base side **320**, left side **310**, and right side **315**. Left side **310** and right side **315** further have end burner sections **312** and **317**, respectively, connected thereto. End burner sections **312** and **317** project toward each other in a direction away from left side **310** and right side **315**, respectively. In addition, left side **310** and right side **315** have intermediate burner sections **314** and **319**, respectively. Left intermediate burner section **314** and right intermediate burner section **319** are connected to left side **310** and right side **315** at approximately midway along the length of these sides, and project into the middle of air-gas distribution section **305**. Again, this arrangement provides enhanced coverage for heating a surface, while still maintaining open-loop geometry. Either of distribution sections **205** or **305** can be used in burner **100**.

While the present disclosure has been described with reference to one or more embodiments, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the present disclosure. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the disclosure without departing from the scope thereof. Therefore, it is intended that the present disclosure not be limited to the particular embodiments disclosed as the best mode contemplated, but that the disclosure will include all embodiments falling within the scope of the appended claims.

What is claimed is:

1. A gas burner, comprising:

an air-gas mixture distribution section comprising a first side, a second side, and a third side formed in a U-shaped open loop geometry;

a top heating surface on said air-gas mixture distribution section having a plurality of ports disposed thereon;

an inlet disposed on a bottom surface of said first side of said air-gas mixture distribution section, for receiving an air-gas mixture, wherein said bottom surface is opposite to said top heating surface;

a gas inlet valve;

a combustion blower;

a feed pipe, wherein said feed pipe is in fluid communication with said inlet, said gas inlet valve, and said combustion blower; and

a distribution diffuser mounted within said first side of said air-gas mixture distribution section, between said inlet and said top heating surface, so that a chamber is between said distribution diffuser and said inlet, within said first side of said distribution section, and wherein said distribution diffuser has a top surface that substantially conforms to an underside of said top heating surface within said first side, and extends at least partially along said second and said third side,

wherein said distribution section and said distribution diffuser evenly distribute the pressure of the air-gas mixture within the gas burner.

2. The gas burner of claim **1**, wherein said first side is shorter than both said second side and said third side.

3. The gas burner of claim **1**, wherein said top heating surface is substantially flat.

4. The gas burner of claim **1**, wherein the gas burner is mounted in a burner tray assembly.

5. The gas burner of claim **1**, wherein said plurality of ports are arranged in sequences of ports that are parallel and transverse to a longitudinal axis of said sides.

6. The gas burner of claim **5**, wherein said pattern of ports delivers a uniform or distributed heat pattern to evenly heat a surface above said distribution section.

7. The gas burner of claim **1**, wherein each of said first side, said second side, and said third side are straight, rectangular sections.

8. The gas burner of claim **1**, wherein said top surface of said distribution diffuser is a fine mesh screen that extends at least partially along said second and said third side of said air-gas mixture distribution section.

9. A burner tray assembly comprising:

a front wall, a back wall and a bottom wall having a gas burner mounted therein, said gas burner having an air-gas mixture distribution section comprising a first side, a second side, and a third side, formed in a U-shaped open loop geometry;

an insulation layer disposed along an interior of said front wall, said back wall and said bottom wall;

a temperature sensor extending through said bottom wall;

an inlet disposed on a bottom surface of said first side of said air-gas mixture distribution section, for receiving the air-gas mixture, wherein said bottom surface is opposite to said top heating surface;

a gas inlet valve;

a combustion blower;

a distribution diffuser mounted in said first side of said air-gas mixture distribution section, between said inlet and said top heating surface, so that a chamber is between said distribution diffuser and said inlet, within said first side of said distribution section, and wherein said distribution diffuser has a top surface that substantially conforms to an underside of said top heating surface within said first side, and extends at least partially along said second and said third side to a distance sufficient to balance the pressure in said gas burner and to provide uniform or distributed flame characteristics for said distribution section; and

a feed pipe, wherein said feed pipe is in fluid communication with said inlet, said gas inlet valve, and said combustion blower.

10. The burner tray assembly of claim **9**, wherein each of said sides has a top heating surface.

11. The burner tray assembly of claim **10**, wherein said top heating surface has a plurality of ports disposed thereon.

12. The burner tray assembly of claim **9**, wherein said first side of said air-gas mixture distribution section has an inlet disposed thereon.

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